

# **molecular microbiology**

---

**Edited by**

**C. F. Higgins, G. K. Schoolnik and  
A. P. Pugsley**

**VOLUME 3 1989**

**BLACKWELL SCIENTIFIC PUBLICATIONS**

© 1989 Blackwell Scientific Publications Ltd. Authorization to photocopy for internal or personal use or the internal or personal use of specific clients is granted by Blackwell Scientific Publications Ltd for libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$05.00 per copy is paid directly to the CCC, 27 Congress Street, Salem, MA 01970, USA. This consent does not extend to other kinds of copying, such as copying for general distribution for advertising or promotional purposes, for creating new collective works or for resale. Special requests should be addressed to the Editor. 0950-382X/89 \$05.00.

**BLACKWELL SCIENTIFIC PUBLICATIONS**  
Osney Mead, Oxford OX2 0EL  
8 John Street, London WC1N 2ES  
23 Ainslie Place, Edinburgh EH3 6AJ  
3 Cambridge Center, Suite 208, Cambridge,  
MA 02142, USA  
107 Barry Street, Carlton, Victoria 3053, Australia

Typeset by R D Composition Ltd, Glasgow, Scotland.  
Printed and bound in Great Britain by The Devonshire Press, Torquay,  
England.  
ISSN 0950-382X

## Contents

### VOLUME 3 NUMBER 1

- 1 Editorial
- 3 Three  $\alpha$ -amylase genes of *Aspergillus oryzae* exhibit identical intron-exon organization  
S. Wirsel, A. Lachmund, G. Wildhardt & E. Ruttkowski
- 15 Identification of the membrane component of the anion pump encoded by the arsenical resistance operon of R-factor R773  
M. J. D. San Francisco, L. S. Tisa & B. P. Rosen
- 23 Sequences required for regulation of arginine biosynthesis promoters are very conserved between *Bacillus subtilis* and *Escherichia coli*  
M. C. M. Smith, L. Czaplewski, A. K. North, S. Baumberg & P. G. Stockley
- 29 Transformation of *Mycobacterium smegmatis* with *Escherichia coli* plasmids carrying a selectable resistance marker  
Z. F. Zainuddin, Z. M. Kunze & J. W. Dale
- 35 Penicillin-binding protein 2 genes of non- $\beta$ -lactamase-producing, penicillin-resistant strains of *Neisseria gonorrhoeae*  
C. G. Dowson, A. E. Jephcott, K. R. Gough & B. G. Spratt
- 43 Conserved lipoprotein H.8 of pathogenic *Neisseria* consists entirely of pentapeptide repeats  
J. P. Woods, S. M. Spinola, S. M. Strobel & J. G. Cannon
- 49 The virulence-associated gonococcal H.8 gene encodes 14 tandemly repeated pentapeptides  
V. Baehr, E. C. Gotschlich & P. J. Hitchcock
- 57 Probing the surface of *Neisseria gonorrhoeae*: immunoelectron microscopic studies to localize cyanogen bromide fragment 2 in gonococcal pili  
E. N. Robinson, Jr, C. M. Clemens, G. K. Schoolnik & Z. A. McGee
- 65 Construction, transfer and properties of a novel temperature-sensitive integrable plasmid for genomic analysis of *Staphylococcus aureus*  
J. B. Luchansky, A. G. Atherly & A. K. Benson
- 79 Characterization of a protein inhibitor of extracellular proteases produced by *Erwinia chrysanthemi*  
S. Letoffé, P. Deleplaire & C. Wandersman

- 87 Transcription of *rhiA*, a gene on a *Rhizobium leguminosarum* bv. *viciae* Sym plasmid, requires *rhiR* and is repressed by flavanoids that induce *nod* genes  
A. Economou, F. K. L. Hawkins, J. A. Downie & A. W. B. Johnston
- 95 Extensive re-modelling of the transpeptidase domain of penicillin-binding protein 2B of a penicillin-resistant South African isolate of *Streptococcus pneumoniae*  
C. G. Dowson, A. Hutchison & B. G. Spratt
- 103 Phosphoenolpyruvate:sugar phosphotransferase system of *Bacillus subtilis*: nucleotide sequence of *ptsX*, *ptsH* and 5'-end of *ptsI* and evidence for a *ptsHI* operon  
G. Gonzy-Tréboul, M. Zagorec, M.-C. Rain-Guion & M. Steinmetz

#### Notes

- 113 Partial nucleotide sequence of the *pts* operon in *Salmonella typhimurium*: comparative analyses in five bacterial genera  
B. Schnierow, M. Yamada & M. H. Saier, Jr

#### MicroReview

- 119 Genetics of pertussis toxin  
R. Gross, B. Aricò & R. Rappuoli

### VOLUME 3 NUMBER 2

- 125 Biochemical and antigenic characterization of the *Mycobacterium tuberculosis* 71 kD antigen, a member of the 70 kD heat-shock protein family  
A. Mehliert & D. B. Young
- 131 The class 1 outer membrane protein of *Neisseria meningitidis*: gene sequence and structural and immunological similarities to gonococcal porins  
A. K. Barlow, J. E. Heckels & I. N. Clarke
- 141 The *Bradyrhizobium japonicum* *fixBCX* operon: identification of *fixX* and of a 5' mRNA region affecting the level of the *fixBCX* transcript  
M. Gubler, T. Zürcher & H. Hennecke
- 149 Fine-tuning of *nif* and *fix* gene expression by upstream activator sequences in *Bradyrhizobium japonicum*  
M. Gubler

- Addendum**
- 161 Trimethoprim resistance transposon Tn4003 from *Staphylococcus aureus* encodes genes for a dihydrofolate reductase and thymidylate synthetase flanked by three copies of IS257  
D. A. Rouch, L. J. Messerotti, L. S. L. Loo,  
C. A. Jackson & R. A. Skurray
- 177 Isolation, molecular characterization and expression of the *ushB* gene of *Salmonella typhimurium* which encodes a membrane-bound UDP-sugar hydrolase  
A. R. Garrett, L. A. Johnson & I. R. Beacham
- 187 Characterization of a *cis* regulatory DNA element necessary for formate induction of the formate dehydrogenase gene (*fdhF*) of *Escherichia coli*  
A. Birkmann & A. Böck
- 197 The streptokinase gene of group A streptococci: cloning, expression in *Escherichia coli*, and sequence analysis  
T.-T. Huang, H. Malke & J. J. Ferretti
- 207 Molecular cloning and characterization of chromosomal virulence region *kcpA* of *Shigella flexneri*  
M. Yamada, C. Sasakawa, N. Okada, S.-I. Makino & M. Yoshikawa
- 215 Mistranslation induces the heat-shock response in the yeast *Saccharomyces cerevisiae*  
C. M. Grant, M. Firoozan & M. F. Tuite
- 221 Cloning of a surface protein antigen gene from serotype c *Streptococcus mutans*  
N. Okahashi, C. Sasakawa, M. Yoshikawa, S. Hamada & T. Koga
- 229 Nucleotide sequence and analysis of the *N*-terminal coding region of the *Spodoptera*-active  $\delta$ -endotoxin gene of *Bacillus thuringiensis aizawai* 7.29  
V. Sanchis, D. Lereclus, G. Menou, J. Chaufaux, S. Guo & M.-M. Lecadet
- 239 Receptor for IgA in group A streptococci: cloning of the gene and characterization of the protein expressed in *Escherichia coli*  
G. Lindahl & B. Åkerström
- Notes**
- 249 Molecular cloning and characterization of a genetic region from *Serratia marcescens* involved in DNA repair  
K. E. Murphy & H. D. Braymer
- 257 Mutations that alter the helix-turn-helix region of the *spolIAC* protein: a *Bacillus subtilis* sporulation-specific sigma factor  
M. D. Yudkin, J. H. Millonig & L. Appleby
- 261 Cloning of *xcp* genes located at the 55 min region of the chromosome and involved in protein secretion in *Pseudomonas aeruginosa*  
A. Filloux, M. Bally, M. Murgier, B. Wretlind & A. Lazdunski
- 267 Mapping and characterization of mutants of the *Escherichia coli* cell division gene, *ftsA*  
A. C. Robinson, K. J. Begg, J. Sweeney,  
A. Condie and W. D. Donachie
- VOLUME 3 NUMBER 3**
- 269 The expression of the DNA ligase gene of *Escherichia coli* is stimulated by relaxation of chromosomal supercoiling  
J. C. Liebart, L. Paolozzi, M. G. Camera, A. M. Pedrini & P. Ghelardini
- 275 The gene for the precursor of plastocyanin from the cyanobacterium *Anabaena* sp. PCC 7937: isolation, sequence and regulation  
J. van der Plas, A. Bovy, F. Kruyt, G. de Vrieze, E. Dassen, B. Klein & P. Weisbeek
- 285 Molecular cloning of *outJ* gene involved in pectate lyase secretion by *Erwinia chrysanthemi*  
J. Ji, N. Hugouvieux-Cotte-Pattat & J. Robert-Baudouy
- 295 Molecular cloning and expression in *Escherichia coli* K-12 of the O101 *rfb* region from *E. coli* B41 (O101:K99/F41) and genetic relationship to other O101 *rfb* loci  
M. W. Heuzenroeder, D. W. Beger, C. J. Thomas & P. A. Manning
- 303 Molecular cloning and characterization of the PCF8775 CS5 antigen from an enterotoxigenic *Escherichia coli* 0115:H40 isolated in Central Australia  
M. W. Heuzenroeder, B. L. Neal, C. J. Thomas, R. Halter & P. A. Manning
- 311 The major outer membrane protein of *Chlamydia trachomatis*: critical binding site and conformation determine the specificity of antibody binding to viable chlamydiae  
J. W. Conlan, M. Kajbaf, I. N. Clarke, S. Chantler & M. E. Ward
- 319 Protein G genes: structure and distribution of IgG-binding and albumin-binding domains  
U. Sjöbring, L. Björck & W. Kastern
- 329 The O75X adhesin of uropathogenic *Escherichia coli* is a type IV collagen-binding protein  
B. Westerlund, P. Kuusela, J. Risteli, L. Risteli, T. Vartio, H. Rauvala, R. Virkola & T. K. Korhonen
- 339 Genetic analysis of phycobilisome mutants in the cyanobacterium *Synechococcus* sp. PCC 6301  
R. Kalla, L. K. Lind & P. Gustafsson
- 349 Fine structural analysis of the *Zoogloea ramigera* *phbA-phbB* locus encoding  $\beta$ -ketothiolase and acetoacetyl-CoA reductase: nucleotide sequence of *phbB*  
O. P. Peoples & A. J. Sinskey

- 359 **Molecular characterization of a cell wall-associated proteinase gene from *Streptococcus lactis* NCDO763**  
M. Kiwaki, H. Ikemura, M. Shimizu-Kadota & A. Hirashima
- 371 **Regulation of exotoxin A synthesis in *Pseudomonas aeruginosa*: characterization of *toxA-lacZ* fusions in wild-type and mutant strains**  
M. L. Vasil, C. C. R. Grant & R. W. Prince
- 383 **Phospholipase C and haemolytic activities of *Clostridium perfringens* alpha-toxin, cloned in *Escherichia coli*: sequence and homology with a *Bacillus cereus* phospholipase C**  
D. Leslie, N. Fairweather, D. Pickard, G. Dougan & M. Kehoe
- 393 **Molecular and mutational analysis of three genes preceding *pyrE* on the *Escherichia coli* chromosome**  
P. Poulsen, J. T. Andersen & K. F. Jensen
- 405 **Functional characterization of a putative internal promoter sequence between the 16S and the 23S RNA genes within the *Escherichia coli rrmB* operon**  
M. Zacharias & R. Wagner
- 411 ***virG* of *Agrobacterium tumefaciens* plasmid pTiC58 encodes a DNA-binding protein**  
B. S. Powell, P. M. Rogowsky & C. I. Kado
- 421 **Cloning and analysis of the gene for the major outer membrane lipoprotein from *Pseudomonas aeruginosa***  
P. Cornelis, A. Bouia, A. Belarbi, A. Guyonvarch, B. Kammerer, V. Hannaert & J. C. Hubert
- 429 **The biochemical basis for growth inhibition by L-phenylalanine in *Neisseria gonorrhoeae***  
R. K. Bhatnagar, A. Berry, A. T. Hendry & R. A. Jensen
- 437 **Gene structure and precursor processing of a novel *Bacillus subtilis* spore coat protein**  
A. I. Aronson, H.-Y. Song & N. Bourne
- 445 **Integration of the *Serratia marcescens* haemolysin into human erythrocyte membranes**  
E. Schiebel & V. Braun
- MicroReview*
- 455 **Nucleoprotein structures at positively regulated bacterial promoters: homology with replication origins and some hypotheses on the quaternary structure of the activator proteins in these complexes**  
O. Raibaud

## VOLUME 3 NUMBER 4

- 459 **The *Escherichia coli* protein, Fis: specific binding to the ends of phage Mu DNA and modulation of phage growth**  
M. Bétermier, V. Lefrère, C. Koch, R. Alazard & M. Chandler
- 469 **Sequence analysis of the wall-associated protein precursor of *Streptococcus mutans* antigen A**  
J. J. Ferretti, R. R. B. Russell & M. L. Dao
- 479 **Molecular analysis of linear plasmid-encoded major surface proteins, OspA and OspB, of the Lyme disease spirochaete *Borrelia burgdorferi***  
S. Bergström, V. G. Bundo & A. G. Barbour
- 487 **The high-affinity K<sup>+</sup>-translocating ATPase complex from *Bacillus acidocaldarius* consists of three subunits**  
J. Hafer, A. Siebers & E. P. Bakker
- 497 ***Klebsiella pneumoniae* strain K21: evidence for the rapid secretion of an unacylated form of pullulanase**  
M. G. Kornacker, A. Boyd, A. P. Pugsley & G. S. Plastow
- 505 **Sequence of the *nagBACD* operon in *Escherichia coli* K12 and pattern of transcription within the *nag* regulon**  
J. Plumbridge
- 517 **Analysis of the *yopA* gene encoding the Yop1 virulence determinants of *Yersinia* spp.**  
M. Skurnik & H. Wolf-Watz
- 531 **DNA supercoiling in *Escherichia coli*: *topA* mutations can be suppressed by DNA amplifications involving the *toxC* locus**  
C. J. Dorman, A. S. Lynch, N. Ni Bhraint & C. F. Higgins
- 541 **Primary structure, functional organization and expression of nitrogenase structural genes of the thermophilic archaeabacterium *Methanococcus thermolithotrophicus***  
N. Souillard & L. Sibold
- 553 **Cloning and physical characterization of the L-proline catabolism gene cluster of *Aspergillus nidulans***  
E. P. Hull, P. M. Green, H. N. Arst Jr & C. Scazzocchio
- 561 **Sense and antisense transcripts of *traM*, a conjugal transfer gene of the antibiotic resistance plasmid R100**  
W. B. Dempsey
- 571 **IUMS News**  
**New IUMS President**

## VOLUME 3 NUMBER 5

- 573 **Expanded linkage map of *Erwinia chrysanthemi* strain 3937**  
N. Hugouvieux-Cotte-Pattat, S. Reverchon & J. Robert-Baudouy
- 583 **Characterization of the neisserial lipid-modified azurin bearing the H.8 epitope**  
J. P. Woods, J. F. Dempsey, T. H. Kawula, D. S. Barritt & J. G. Cannon
- 593 **Role of cysteine residues and of metal ions in the regulatory functioning of FNR, the transcriptional regulator of anaerobic respiration in *Escherichia coli***  
M. Trageser & G. Unden
- 601 **FNR-dependent repression of the *ndh* gene of *Escherichia coli* and metal ion requirement for FNR-regulated gene expression**  
S. Spiro, R. E. Roberts & J. R. Guest
- 609 **Construction of lac fusions to the inducible arginine- and lysine decarboxylase genes of *Escherichia coli* K12**  
E. A. Auger, K. E. Redding, T. Plumb, L. C. Childs, S.-Y. Meng & G. N. Bennett
- 621 **Molecular characterization and sequence of phosphatidylinositol-specific phospholipase C of *Bacillus thuringiensis***  
M. Lechner, T. Kupke, S. Stefanovic & F. Götz
- 627 **A dual transcriptional activation system for the 230 kb plasmid genes coding for virulence-associated antigens of *Shigella flexneri***  
B. Adler, C. Sasakawa, T. Tobe, S. Makino, K. Komatsu & M. Yoshikawa
- 637 **Topographical alterations in proteins I of *Neisseria gonorrhoeae* correlated with lipooligosaccharide variation**  
R. C. Judd & W. M. Shafer
- 645 **Detection and identification of FaeC as a minor component of K88 fibrillae of *Escherichia coli***  
B. Oudega, M. de Graaf, L. de Boer, D. Bakker, C. E. M. Vader, F. R. Mooi & F. K. de Graaf
- 653 **A bacterial c-type cytochrome can be translocated to the periplasm as an apo form; the biosynthesis of cytochrome cd<sub>1</sub> (nitrite reductase) from *Paracoccus denitrificans***  
M. D. Page & S. J. Ferguson
- 663 **Expression of gonococcal protein II in *Escherichia coli* by translational fusion**  
L. Palmer, G. F. Brooks & S. Falkow
- Notes**
- 673 **Molecular characterization of a surface protein antigen gene from serotype c *Streptococcus mutans*, implicated in dental caries**  
N. Okahashi, C. Sasakawa, M. Yoshikawa, S. Hamada & T. Koga

- 679 **Topology and function of the integral membrane protein conferring immunity to colicin A**  
V. Geli, D. Baty, F. Pattus & C. Lazdunski

*MicroReview*

- 689 **Cloning and characterization of beta-lactam biosynthetic genes**  
J. R. Miller & T. D. Ingolia

## VOLUME 3 NUMBER 6

- 697 **Construction of chimaeric promoter regions by exchange of the upstream regulatory sequences from *fdhF* and *nif* genes**  
A. Birkmann, H. Hennecke & A. Böck
- 705 **The proline transport protein of *Aspergillus nidulans* is very similar to amino acid transporters of *Saccharomyces cerevisiae***  
V. Sophianopoulou & C. Scazzocchio
- 715 **Transcription of the *sulA-ompA* region of *Escherichia coli* during the SOS response and the role of an antisense RNA molecule**  
S. T. Cole & N. Honoré
- 723 **Identification, molecular cloning and sequence analysis of a gene cluster encoding the Class II fructose 1,6-bisphosphate aldolase, 3-phosphoglycerate kinase and a putative second glyceraldehyde 3-phosphate dehydrogenase of *Escherichia coli***  
P. R. Alefonder & R. N. Perham
- 733 **Cloning and expression of plasmid DNA sequences involved in *Salmonella* serotype Typhimurium virulence**  
F. Norel, C. Coynault, I. Miras, D. Hermant & M. Y. Popoff
- 745 **The *Rhizobium meliloti* host range *nodQ* gene encodes a protein which shares homology with translation elongation and initiation factors**  
E. Cervantes, S. B. Sharma, F. Maillet, J. Vasse, G. Truchet & C. Rosenberg
- 757 **The *Escherichia coli* enterobactin biosynthesis gene, *entD*: nucleotide sequence and membrane localization of its protein product**  
S. K. Armstrong, G. S. Pettis, L. J. Forrester & M. A. McIntosh
- 767 **A *Yersinia pestis*-specific DNA fragment encodes temperature-dependent coagulase and fibrinolysin associated phenotypes**  
K. A. McDonough & S. Falkow
- 777 **Expression and phase variation of gonococcal P.II genes in *Escherichia coli* involves ribosomal frameshifting and slipped-strand mispairing**  
R. J. Belland, S. G. Morrison, P. van der Ley & J. Swanson

- 787 **Transcriptional regulation of F plasmid gene *srrB*: rifampicin-promoted *in vitro* readthrough of a terminator in the leader region**  
S. Akimoto, T. Sakikawa, K. Ono, T. Ono & Y. Ohnishi
- 797 **Analysis of a cloned sequence of *Legionella pneumophila* encoding a 38 kD metalloprotease possessing haemolytic and cytotoxic activities**  
F. D. Quinn & L. S. Tompkins
- 807 **Immunity protein is not required for the bactericidal activity of colicin E3**  
V. Escuyer, D. Perrin & M. Mock
- 813 **Analysis of C<sub>4</sub>-dicarboxylate transport genes in *Rhizobium meliloti***  
D. K. Yarosh, T. C. Charles & T. M. Finan
- 825 **The *Azorhizobium caulinodans* nitrogen-fixation regulatory gene, *nifA*, is controlled by the cellular nitrogen and oxygen status**  
P. Ratet, K. Pawlowski, J. Schell & F. J. de Bruijn
- Notes**
- 839 **The ribonucleoside diphosphate reductase gene (*nrdA*) of *Escherichia coli* carries a repetitive extragenic palindromic (REP) sequence in its 3' structural terminus**  
E. Merino & F. Bolívar

#### VOLUME 3 NUMBER 7

- 843 **Detection and identification of mycobacteria by amplification of mycobacterial DNA**  
A. J. Hance, B. Grandchamp, V. Lévy-Frébault, D. Lecossier, J. Rauzier, D. Bocart and B. Gicquel
- 851 **Independent and coupled translational initiation of *atp* genes in *Escherichia coli*: experiments using chromosomal and plasmid-borne *lacZ* fusions**  
B. Gerstel and J. E. G. McCarthy
- 861 ***Pseudomonas aeruginosa* cytotoxin: the nucleotide sequence of the gene and the mechanism of activation of the protoxin**  
T. Hayashi, Y. Kamio, F. Hishinuma, Y. Usami, K. Titani and Y. Terawaki
- 869 **Molecular genetic analysis of FNR-dependent promoters**  
K. Eiglmeier, N. Honoré, S. Iuchi, E. C. C. Lin and S. T. Cole
- 879 **Characterization of *Rhizobium phaseoli* Sym plasmid regions involved in nodule morphogenesis and host-range specificity**  
M. A. Cevallos, M. Vázquez, A. Dávalos, G. Espín, J. Sepúlveda and C. Quinto
- 891 **Assembly of colicin genes from a few DNA fragments. Nucleotide sequence of colicin D**  
U. Roos, R. E. Harkness and V. Braun

- 903 **Cloning and characterization of an *Escherichia coli* gene, *pcnB*, affecting plasmid copy number**  
J. B. March, M. D. Colloms, D. Hart-Davis, I. R. Oliver and M. Masters
- 911 **RFLP-based genetic map of *Phanerochaete chrysosporium* ME446: lignin peroxidase genes occur in clusters**  
U. Raeder, W. Thompson and P. Broda
- 919 **Genetic factors influencing lignin peroxidase activity in *Phanerochaete chrysosporium* ME446**  
U. Raeder, W. Thompson and P. Broda
- 925 **Regulation of the phase switch controlling expression of type 1 fimbriae in *Escherichia coli***  
L. Pallesen, O. Madsen and P. Klemm
- 933 **An overlap between osmotic and anaerobic stress responses: a potential role for DNA supercoiling in the coordinate regulation of gene expression**  
N. Ni Bhriain, C. J. Dorman and C. F. Higgins
- 943 **The *nifA* gene product from *Rhizobium leguminosarum* biovar *trifolii* lacks the N-terminal domain found in other NifA proteins**  
S. E. Iismaa and J. M. Watson
- 957 **A *Mycoplasma* genetic element resembling prokaryotic insertion sequences**  
R. V. Ferrell, M. B. Heidari, K. S. Wise and M. A. McIntosh

- 969 **Specificity of signal molecules in the activation of *Agrobacterium* virulence gene expression**  
L. S. Melchers, A. J. G. Regensburg-Tuink, R. A. Schilperoort and P. J. J. Hooykaas
- Notes**

- 979 **Specificity of insertion of IS91, an insertion sequence present in  $\alpha$ -haemolysin plasmids of *Escherichia coli***  
M. V. Mendiola and F. de la Cruz
- 985 **Analysis of the chromosomal location of two copies of a *Bordetella pertussis* insertion sequence**  
W. L. McPheat, J. H. Hanson, I. Livey and J. S. Robertson
- 991 **Genetic evidence that DicF, a second division inhibitor encoded by the *Escherichia coli* *dicB* operon, is probably RNA**  
F. Bouché and J.-P. Bouché

#### VOLUME 3 NUMBER 8

- 995 **The terminus of the *Escherichia coli* chromosome is flanked by several polar replication pause sites**  
V. François, J. Louarn and J.-M. Louarn

- 1003 Yeast 2  $\mu$ m vectors replicate and undergo recombination in *Torulaspora delbrueckii*  
C. Compagno, B. M. Ranzi and E. Martegani
- 1011 A novel, non-invasive promoter probe vector: cloning of the osmoregulated *proU* promoter of *Escherichia coli* K12  
S. F. Park, D. A. Stirling, C. S. J. Hulton, I. R. Booth, C. F. Higgins and G. S. A. B. Stewart
- 1025 Molecular characterization of the *proU* loci of *Salmonella typhimurium* and *Escherichia coli* encoding osmoregulated glycine betaine transport systems  
D. A. Stirling, C. S. J. Hulton, L. Waddell, S. F. Park, G. S. A. B. Stewart, I. R. Booth and C. F. Higgins
- 1039 Transcriptional polarity enhances the contribution of the internal promoter, *ilvEp*, in the expression of the *ilvGMEDA* operon in wild-type *Escherichia coli* K12  
J. M. Lopes, N. Soliman, P. K. Smith and R. P. Lawther
- 1053 Differential gene expression during sporulation in *Bacillus subtilis*: regulation of the *spoVJ* gene  
J. Errington, L. Wootten, J. C. Dunkerley and D. Foulger
- 1061 Localization and functional analysis of the regulated promoter from the *Streptomyces glaucescens mel* operon  
M. Geistlich, S. Irniger and R. Hüttner
- 1071 Identification of *Bacillus subtilis* genes expressed early during sporulation  
C. Mathiopoulos and A. L. Sonenshein
- 1083 Responses of *Haemophilus pleuropneumoniae* to iron restriction: changes in the outer membrane protein profile and the removal of iron from porcine transferrin  
D. F. Niven, J. Donga and F. S. Archibald
- 1091 Signalling proteins in enterobacterial AmpC  $\beta$ -lactamase regulation  
S. Lindquist, M. Galleni, F. Lindberg and S. Normark
- 1103 Cloning and analysis of a deletable tetracycline-resistance determinant of *Streptomyces lividans* 1326  
A. Kessler, W. Dittrich, M. Betzler and H. Schrempf
- 1111 Extensive sequence homology between IgA receptor and M proteins in *Streptococcus pyogenes*  
E. Frithz, L.-O. Hedén and G. Lindahl
- 1121 Regulation of enterobacterial cephalosporinase production: the role of a membrane-bound sensory transducer  
N. Honoré, M.-H. Nicolas and S. T. Cole
- 1131 Translational repression of TEM  $\beta$ -lactamase synthesis as a response of *Escherichia coli* to heat shock  
Y. Kuriki

*MicroReview*

- 1141 Reverse transcriptase in bacteria  
D. Lim and W. K. Maas

## VOLUME 3 NUMBER 9

- 1145 Characterization of amber mutations in bacteriophage Mu transposase: a functional analysis of the protein  
L. Desmet, M. Faelen, M.-J. Gama, A. Ferhat and A. Toussaint
- 1159 Functional domains of bacteriophage Mu transposase: properties of C-terminal deletions  
M. Bétermier, R. Alazard, V. Lefrère and M. Chandler
- 1173 Molecular cloning and expression of a locus (*mdoA*) implicated in the biosynthesis of membrane-derived oligosaccharides in *Escherichia coli*  
J.-M. Lacroix, M. Tempête, B. Menichi and J.-P. Bohin
- 1183 Cloning a genomic region required for a high-affinity iron-uptake system in *Rhizobium meliloti* 1021  
P. R. Gill, Jr and J. B. Neilands
- 1191 Functional organization and nucleotide sequence of virulence Region-2 on the large virulence plasmid in *Shigella flexneri* 2a  
C. Sasakawa, B. Adler, T. Tobe, N. Okada, S. Nagai, K. Komatsu and M. Yoshikawa
- 1203 The transition-state transcriptional regulator, AbrB, of *Bacillus subtilis* is autoregulated during vegetative growth  
M. Strauch, M. Perego, D. Burbulys and J. A. Hoch
- 1211 Conserved serine-rich sequences in xylanase and cellulase from *Pseudomonas* subspecies *cellulosa*: internal signal sequence and unusual protein processing  
J. Hall, G. P. Hazlewood, N. S. Huskisson, A. J. Durrant and H. J. Gilbert
- 1221 Molecular and genetic analysis of the fructose-glucose transport system in the cyanobacterium *Synechocystis* PCC6803  
C.-C. Zhang, M.-C. Durand, R. Jeanjean and F. Joset
- 1231 Isolation and characterization of functional shiga toxin subunits and renatured holotoxin  
A. Donohue-Rolfe, M. Jacewicz and G. T. Keusch
- 1237 Characterization of the *virA* virulence gene of the nopaline plasmid pTiC58 of *Agrobacterium tumefaciens*  
P. Morel, B. S. Powell, P. M. Rogowsky and C. I. Kado

- 1247 **The role of the sporulation gene *spolIIIE* in the regulation of prespore-specific gene expression in *Bacillus subtilis***  
D. Foulger and J. Errington
- 1257 **The nucleotide sequence of the *rodC* operon of *Bacillus subtilis***  
A. L. Honeyman and G. C. Stewart
- 1269 **Expression of the *recA* gene during induction of the SOS response in *Bacillus subtilis* recombination-deficient strains**  
M. Gassel and J. C. Alonso
- 1277 **Membrane topology of penicillin-binding protein 3 of *Escherichia coli***  
L. D. Bowler and B. G. Spratt
- Notes**
- 1287 **Osmotic regulation of porin expression: a role for DNA supercoiling**  
K. A. Graeme-Cook, G. May, E. Bremer and C. F. Higgins
- Reviews**
- 1295 **The role of the cell surface in social and adventurous behaviour of myxobacteria**  
L. J. Shimkets
- 1301 **Iron and virulence in *Shigella***  
S. M. Payne
- VOLUME 3 NUMBER 10
- 1307 **Structural and functional analysis of the mini-circle, a transposable element of *Streptomyces coelicolor* A3(2)**  
D. J. Henderson, D. J. Lydiate and D. A. Hopwood
- 1319 **Cloning and characterization of *NSP1*, a locus encoding a component of a *CDC25*-dependent, nutrient-responsive pathway in *Saccharomyces cerevisiae***  
M. L. Tripp, R. A. Bouchard and R. Piñón
- 1329 **Compartmentalization of the periplasm at cell division sites in *Escherichia coli* as shown by fluorescence photobleaching experiments**  
M. Foley, J. M. Brass, J. Birmingham, W. R. Cook, P. B. Garland, C. F. Higgins and L. I. Rothfield
- 1337 **Nucleotide sequences of the *pbpX* genes encoding the penicillin-binding proteins 2x from *Streptococcus pneumoniae* R6 and a cefotaxime-resistant mutant, C506**  
G. Laible, R. Hakenbeck, M. A. Sicard, B. Joris and J.-M. Ghysen
- 1349 **Positive control of colanic acid synthesis in *Escherichia coli* by *rmpA* and *rmpB*, two virulence-plasmid genes of *Klebsiella pneumoniae***  
X. Nassif, N. Honoré, T. Vasselon, S. T. Cole and P. J. Sansonetti
- 1361 **Identification of amino acid sequences that can function as translocators of  $\beta$ -lactamase in *Escherichia coli***  
Y. Zhang and J. K. Broome-Smith
- 1371 **Transcriptional regulation of cell division genes in *Escherichia coli***  
S. J. Dewar, V. Kagan-Zur, K. J. Begg and W. D. Donachie
- 1379 **Unique sequences in region VI of the flagellin gene of *Salmonella typhi***  
G. Frankel, S. M. C. Newton, G. K. Schoolnik and B. A. D. Stocker
- 1385 **CRP/cAMP- and CytR-regulated promoters in *Escherichia coli* K12: the *cdd* promoter**  
P. Valentin-Hansen, B. Holst, J. Josephsen, K. Hammer and B. Albrechtsen
- 1391 **Location and molecular cloning of the structural gene for the deoxyguanosine triphosphate triphosphohydrolase of *Escherichia coli***  
S. Quirk, D. Seto, S. K. Bhatnagar, P. Gauss, L. Gold and M. J. Bessman
- 1397 **Transcription antitermination in an *Escherichia coli* haemolysin operon is directed progressively by cis-acting DNA sequences upstream of the promoter region**  
V. Koronakis, M. Cross and C. Hughes
- 1405 **Molecular characterization of a gene from *Saccharopolyspora erythraea* (*Streptomyces erythraeus*) which is involved in erythromycin biosynthesis**  
N. Dhillon, R. S. Hale, J. Cortes and P. F. Leadlay
- 1415 **Relationship between the *pel* genes of the *pelADE* cluster in *Erwinia chrysanthemi* strain B374**  
F. van Gijsegem
- 1425 **Transcriptional induction of *Streptomyces cacaoi*  $\beta$ -lactamase by a  $\beta$ -lactam compound**  
M. Forsman, L. Lindgren, B. Häggström and B. Jaurin
- Notes**
- 1433 **Subcellular localization of proteins encoded by the phenotypically cryptic plasmid of *Neisseria gonorrhoeae*: biological evidence for outer membrane association of the *cppB* gene product**  
R. B. Aalen, I. Lossius and W. B. Gundersen
- 1441 **Nucleotide sequence of the regulatory *nifA* gene of *Rhizobium leguminosarum* PRE: transcriptional control sites and expression in *Escherichia coli***  
P. W. Roelvink, J. G. J. Hontelez, A. van Kammen and R. C. van den Bos
- MicroReviews**
- 1449 **Mammalian cell adhesion functions and cellular penetration of enteropathogenic *Yersinia* species**  
R. R. Isberg

- 1455 **The *Yersinia* yop regulon**  
G. Cornelis, T. Biot, C. Lambert de Rouvroit,  
T. Michiels, B. Mulder, C. Sluiters, M.-P. Sory,  
M. Van Bouchaute and J.-C. Vanooteghem
- IUMS News**
- 1461 **Annual Report of the International Union of Microbiological Societies**  
S. W. Glover
- VOLUME 3 NUMBER 11
- 1463 **A family of genes encoding a cell-killing function may be conserved in all Gram-negative bacteria**  
L. K. Poulsen, N. W. Larsen, S. Molin and  
P. Anderson
- 1473 **An electrophoretic karyotype and assignment of ribosomal genes to resolved chromosomes of *Pneumocystis carinii***  
T. Yoganathan, H. Lin and G. A. Buck
- 1481 **The gene for a small stable RNA (10Sa RNA) of *Escherichia coli***  
A. K. Chauhan and D. Apirion
- 1487 **Phosphoribosylpyrophosphate (PRPP)-less mutants of *Escherichia coli***  
B. Hove-Jensen
- 1493 **Mapping the surface regions of *Pseudomonas aeruginosa* PAK pilin: the importance of the C-terminal region for adherence to human buccal epithelial cells**  
K. K. Lee, P. Doig, R. T. Irvin, W. Paranchych and  
R. S. Hodges
- 1501 **Isolation of  $\alpha$ -tubulin genes from the human malaria parasite, *Plasmodium falciparum*: sequence of  $\alpha$ -tubulin**  
S. P. Holloway, P. F. G. Sims, C. J. Delves,  
J. G. Scaife and J. E. Hyde
- 1511 **Cloning of a  $\beta$ -tubulin gene from *Plasmodium falciparum***  
C. J. Delves, R. G. Ridley, M. Goman,  
S. P. Holloway, J. E. Hyde and J. G. Scaife
- 1521 **Characterization of the osmoregulated *Escherichia coli* proU promoter and identification of ProV as a membrane-associated protein**  
G. May, E. Faatz, J. M. Lucht, M. Haardt,  
M. Bolliger and E. Bremer
- 1533 **Specificity of *Bacillus thuringiensis* for lepidopteran larvae: factors involved in vivo and in the structure of a purified protoxin**  
H. Arvidson, P. E. Dunn, S. Strnad and  
A. I. Aronson
- 1545 **Structure and function of hot spots providing signals for site-directed specific recombination and gene expression in *Tn21* transposons**  
F. R. J. Schmidt, E. J. Nücke and  
R. B. Henschke
- 1557 **Upstream activating sequences that are shared by two divergently transcribed operons mediate cAMP-CRP regulation of pilus-adhesin in *Escherichia coli***  
M. Göransson, K. Forsman, P. Nilsson and  
B. E. Uhlin
- 1567 **Single and multiple mutations affecting properties of the regulatory gene *nodD* of *Rhizobium***  
J. E. Burn, W. D. Hamilton, J. C. Wootton and  
A. W. B. Johnston
- 1579 **Cloning, expression and sequence analysis of the gene encoding the 120kD surface-exposed protein of *Rickettsia rickettsii***  
R. D. Gilmore, Jr, N. Joste and G. A. McDonald
- 1587 **Isolation of *Erwinia chrysanthemi* mutants altered in pectinolytic enzyme production**  
N. Hugouvieux-Cotte-Pattat and  
J. Robert-Baudouy
- 1599 **Mitochondrial cytochrome b genes with a six-nucleotide deletion or single-nucleotide substitutions confer resistance to antimycin A in the yeast *Kluyveromyces lactis***  
R. Coria, M. Garcia and A. Brunner
- 1605 **pH-regulated gene expression in *Salmonella*: genetic analysis of *aniG* and cloning of the *earA* regulator**  
J. W. Foster and Z. Aliabadi
- 1617 **Genetic transfer systems in *Bacteriodes*: cloning and mapping of the transferable tetracycline-resistance locus**  
D. G. Guiney, P. Hasegawa, K. Bouic and  
B. Matthews
- 1625 **Molecular cloning, nucleotide sequence and fine-structural analysis of the *Corynebacterium glutamicum* fda gene: structural comparison of *C. glutamicum* fructose-1,6-biphosphate aldolase to class I and class II aldolases**  
C. H. von der Osten, C. F. Barbas, III, C.-H. Wong and A. J. Sinskey
- 1639 **The *Escherichia coli* regulatory protein MetJ binds to a tandemly repeated 8bp palindrome**  
B. E. Davidson and I. Saint Girons
- Notes**
- 1649 **The *nodL* gene from *Rhizobium leguminosarum* is homologous to the acetyl transferases encoded by *lacA* and *cysE***  
J. A. Downie

*MicroReviews*

- 1653 RNA polymerase heterogeneity in *Streptomyces coelicolor* A3(2)  
M. J. Buttner
- 1661 Families of bacterial signal-transducing proteins  
R. Gross, B. Aricò and R. Rappuoli

## VOLUME 3 NUMBER 12

- 1669 A novel family of potentially mobile DNA elements encoding site-specific gene-integration functions: integrons  
H. W. Stokes and R. M. Hall
- 1685 Genes for biosynthesis and assembly of CS3 pili of CFA/I enterotoxigenic *Escherichia coli*: novel regulation of pilus production by bypassing an amber codon  
M. B. Jalajakumari, C. J. Thomas, R. Halter and P. A. Manning
- 1697 Regulation of the *RAD2* gene of *Saccharomyces cerevisiae*  
W. Siede, G. W. Robinson, D. Kalainov, T. Malley and E. C. Friedberg
- 1709 Nickel deficiency gives rise to the defective hydrogenase phenotype of *hydC* and *fnr* mutants in *Escherichia coli*  
L.-F. Wu, M.-A. Mandrand-Berthelot, R. Waugh, C. J. Edmonds, S. E. Holt and D. Boxer
- 1719 Phase variants of *Bordetella bronchiseptica* arise by spontaneous deletions in the *vir* locus  
D. M. Monack, B. Aricò, R. Rappuoli and S. Falkow
- 1729 Multi-gene amplification: simultaneous detection of three virulence genes in diarrhoeal stool  
G. Frankel, J. A. Giron, J. Valmassoi and G. K. Schoolnik
- 1735 Analysis of genes coding for the sialic acid-binding adhesin and two other minor fimbrial subunits of the S-fimbrial determinant of *Escherichia coli*  
T. Schmoll, H. Hoschützky, J. Morschhauser, F. Lottspeich, K. Jann and J. Hacker
- 1745 Stability of *Cole*E1-like and pBR322-like plasmids in *Escherichia coli*  
J. Ayala-Sammartin and M. C. Gómez-Eichelmann
- 1753 Molecular linkage of the *nif/fix* and *nod* gene regions in *Rhizobium leguminosarum* biovar *trifoli*  
S. E. Iismaa, P. M. Ealing, K. F. Scott and J. M. Watson

- 1765 Mutations in genes downstream of the *rpoN* gene (encoding  $\sigma^{54}$ ) of *Klebsiella pneumoniae* affect expression from  $\sigma^{54}$ -dependent promoters  
M. J. Merrick and J. R. Coppard

- 1777 Functional analyses of *Proteus mirabilis* wild-type and mutant RecBCD enzymes in *Escherichia coli* reveal a new mutant phenotype  
D. Weichenhan and W. Wackernagel

- 1785 Extracellular and periplasmic isoenzymes of pectate lyase from *Erwinia carotovora* subspecies *carotovora* belong to different gene families  
J. C. D. Hinton, J. M. Sidebotham, D. R. Gill and G. P. C. Salmon

- 1797 Diversity of the outer membrane protein P2 gene from major clones of *Haemophilus influenzae* type b  
R. Munson, Jr., C. Bailey and S. Grass

- 1805 Pseudo-allelic relationship between non-homologous genes concerned with biosynthesis of polyglycerol phosphate and polyribitol phosphate teichoic acids in *Bacillus subtilis* strains 168 and W23  
M. Young, C. Mauél, P. Margot and D. Karamata

- 1813 A simple method for maximizing the yields of membrane and exported proteins expressed in *Escherichia coli*  
J. K. Broome-Smith, L. D. Bowler and B. G. Spratt

*MicroReviews*

- 1819 Bacterial polysaccharide capsule synthesis, export and evolution of structural diversity  
G. J. Boulnois and K. Jann

- 1825 Secretion, processing and activation of bacterial extracellular proteases  
C. Wandersman

- 1833 *Salmonella* as an intracellular parasite  
B. B. Finlay and S. Falkow

*Indexes*

- 1843 Subject index

- 1849 Author index